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RAPID CLIMATE VULNERABILITY ASSESSMENT OF SHILLONG, MEGHALAYA

Developing Disaster Resilience Action Plan Through GIS & Prioritising Actions for Natural Disaster Risk Reduction in Urban Agglomerations of Shillong & Gangtok

सत्यमेव जयते

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Shillong City, Meghalaya

Shillong, capital city of Meghalaya, is located on the deeply dissected central upland zone of the Meghalaya Plateau. It is the largest and most urbanized city in the hill state of Meghalaya, comprising 27 municipal wards (2016).

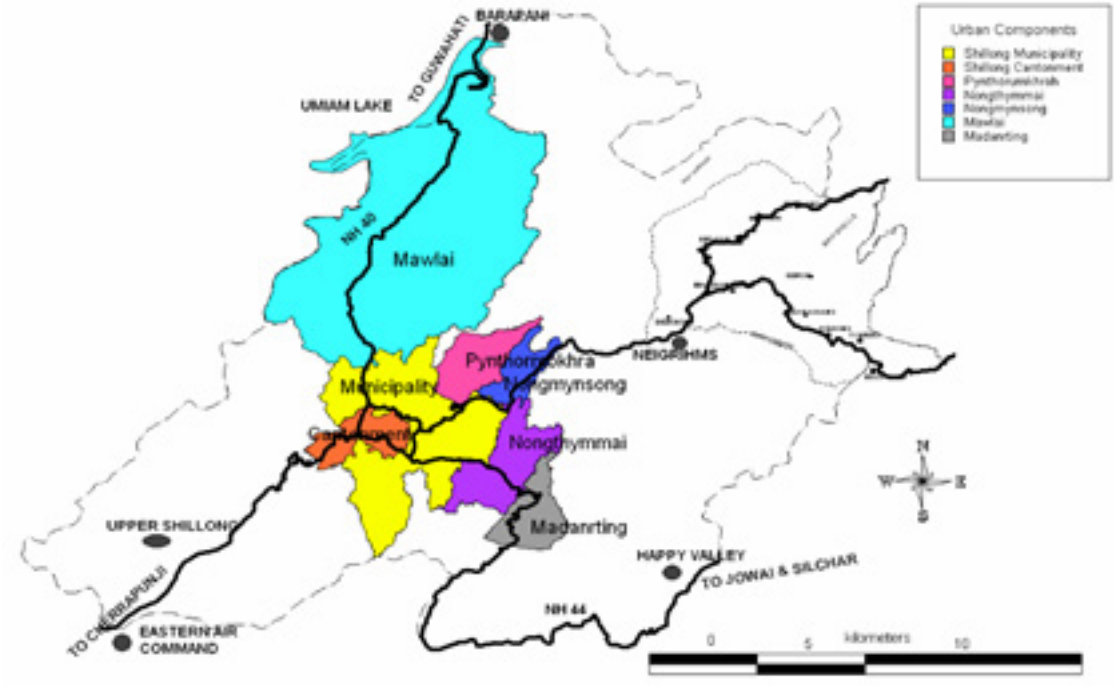

Fig 1: Shillong Urban Agglomeration (Source: CDP, Shillong)

Characteristics of Shillong City

Indicators	Characteristics
Classification of the city	Hill city
Location	25°34'00"N & 91°53'00"E
Area	10.36 sq km
Climate Type	Subtropical highland climate
Temperature[1]	Average Annual Maximum Temperature temperature - 20° C
	Average Annual Minimum Temperature - 12°C
Rainfall	Average annual : 2,162 mm
Height above Mean Sea Level	1,497 mts above MSL

Fig2: Shillong City Overview

Fig3: Panorama of police bazar, Shillong Economic hub

The city is vulnerable to natural hazards like earthquake, landslide, heavy rainfall, floods etc., as well as man -made hazards like road accidents, fires, water scarcity due to rapid growth of urbanization and improper and uncontrolled construction.

[1] IMD, 2010

Hazard Exposure

Sl. No	Hazard Type	Exposure
1	Heavy Rains	Y
2	Drought	Y
3	Cyclones	N
4	Landslides/avalanches	Y
5	Floods	Y
6	Thunderstorm/ Lightning	Y

Hazard Timeline

Hazards	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Flash Floods												
Extreme winds												
Landslide												
Earthquakes												
Thunderstorm/Lightning/Hailstorms												

Fig4: Landslide occurrences in Shillong

Vulnerability Profile of Shillong City

DESCRIPTION	
SOCIO-ECONOMIC CHARACTERICTICS	
Population	• 2001 Population – 132,867; 2011 Population – 143,229. Growth Rate – 7.79% • The population of Shillong forms 68% of the total urban population of the state (CDP).
Density	• ~ 13,825 per sq km in 2011
Slums	• 12 slum pockets, covering 10% of the city population
HAZARD AND EXTREME EVENTS	
Temperature observed	• Average Annual Maximum temperature - 20° C • Average Annual Minimum temperature -12° C
Temperature Projections	• Average temperature is expected to increase by 1.6-1.7°C by 2050 (*Meghalaya State Action Plan on Climate Change, 2015*)
Rainfall observed trend	• Average annual rainfall - 2,162 mm • Hailstorms, thunderstorms and squalls are common
Rainfall projections	• East Khasi hills district is expected to experience an increase of 10-15% in precipitation by 2050. (*Meghalaya State Action Plan on Climate Change, 2015*)
Extreme events : Urban Floods/ Flash Floods	• Frequent incidences of water logging in the city, particularly during rains. • August 2014, incessant rains over 24 hours caused flash flood in the city
Landslides	• In 2014, torrential rain triggered landslide killing 8 people in Mawbah area of Shillong[2] • In 2015, 12 people were killed in the landslides in Meghalaya[3]

[2] http://timesofindia.indiatimes.com/india/Eight-killed-in-Shillong-landslide-flood-toll-34/articleshow/43322889.cms
[3] http://www.ndtv.com/india-news/five-people-killed-in-maghalaya-landslides-772087

Water Scarcity	• Growing water shortages in the face of rapid urbanization. Water scarcity in Shillong is owing to both quality and quantity deficit. • Historical trend indicates decrease in rainfall
Earthquakes	• City falls under the high risk Seismic Zone V • Earthquake measuring 5.2 on the Richter scale rocked the entire northeast India, including Shillong and adjoining Bangladesh on March, 2002[4] another earthquake was recorded in April, 2016
INFRASTRUCTURE STATUS[5]	
Water Supply	• The main source of water supply for Greater Shillong is River Umium. • In 2016-17, almost 77% of the house-holds (HHs) have water supply connection • The per capita water supply is low at 78lpcd • Water connections are not metered; only 12% of the water services cost is recovered.
Sewerage	• 94% HHs in the city have individual or community toilet, of which, 5.82% HHs are being provided sanitary toilet facilities under "Swachh Bharat" mission • No sewage treatment plant; sullage drains either into the River Umshyrpi in the south or in the Um Khrah in the north.
Solid Waste Management	• 159 MT of municipal solid waste is produced per day, 0.4 kg of waste per capita per day. The major solid waste generation sources are households(56%), markets(23%), hotels & restaurants(7%), construction waste(2%), and street sweeping(7%)[6] • In the Shillong Municipal Board (SMB) area, 46% of the waste generated is collected, while outside the SMB area 32% waste is collected. For the entire GSPA (Greater Shillong Planning Area) the percentage of garbage collected is 41%. • Garbage collected is disposed of into the gorges of the trenching ground situated at Mawlai on Shillong Guwahati Road.[7]
Storm Water Drainage	• The drains run for 148.91 km across city and empty into the Umkhrah and Umshyrpi rivers • Storm water drainage network coverage is less than 75%.
Transportation	• Total road length in Shillong is 356 km and road density is 2.05 km/sq km[8]. • Non-Motorized Transport (MNT) has not being stressed upon in the city Comprehensive Mobility Plan (CMP) due to undulating topography and operational constrains
Power	• Average domestic electricity consumption is 300 units /house/day; average commercial consumption is 450 units /shop/day • The agencies responsible for electricity supply, management and distribution are: (1) North Eastern Regional Electricity Board, Shillong; (2) Meghalaya State Electricity Board, Shillong and (3) North Eastern Electric Power Corporation Limited (NEEPCO)
Housing	• Only about 46 % of houses are made of concrete, the remaining are made of wood and burnt bricks. • Of the 65 slum pockets in Shillong UA, all except two slums are on private land.[9] • A total of 3567 housing units are required for slums and urban poor in the city[10].
GOVERNANCE	
Administrative Units assigned to address climate change	• Shillong Municipal Board manages civic services of water supply and solid waste management etc. • East Khasi hills District Commissioner office is leading Disaster Risk Reduction and disaster management planning Meghalaya Basin Development Authority, Meghalaya Disaster Management Authority and the state government are important stakeholders in Disaster Risk Reduction
Willingness of the city to address Climate Change	• The Forest and Environment Department, Government of Meghalaya, and the Meghalaya Basin Development Authority developed Meghalaya State Action Plan on Climate Change in 2015[11] • Local government, including Shillong Municipal Board (SMB), and district unit are implementing Urban Risk Reduction (URR) and Disaster Risk Reduction (DRR) programme with support from United Nations Development Programme (UNDP). This involves integration of risk reduction into urban development programming, while assessing risk and vulnerabilities and strengthening Building codes, Bye laws and development control regulations (DCR). • Urban Local Bodies (ULB) and UNDP are also working on developing ward-level risk –assessment, including understanding of the existing early warning systems, identifying formal & informal mitigation actions and recommendations.

[4] http://www.meghalayatimes.info/index.php/10-front-page/front-page/18383-5-2-intensity-earthquake-rocks-shillong

[5] SLIPS, AMRUT, NIUA, 2016-17

[6] http://www.int-arch-photogramm-remote-sens-spatial-inf-sci.net/XL-7-W3/657/2015/isprsarchives-XL-7-W3-657-2015.pdf

[7] Shillong Municipal Board. http://smb.gov.in/projects.html

[8] City Development Plan, Shillong

[9] http://mhupa.gov.in/writereaddata/csmc015-MeghalayaPPT.pdf

[10] HFA Demand Survey-2016, Census-2011, RAY-2015 & SECC Data

[11] http://www.moef.nic.in/sites/default/files/sapcc/Meghalaya.pdf